

1           19.    (Amended) A method of marketing telephone lines to customers,  
2 comprising:  
3           speed pre-qualifying a plurality of the customer lines using one-ended electrical  
4 measurements performed from a central location; and  
5           setting billing rates of at least a portion of the lines at prices that depend on the  
6 speed qualification of the portion;  
7 wherein at least a portion of the acts of speed pre-qualification include performing  
8 electrical measurements on a proxy line.

1           24.    (Twice Amended) A method of marketing telephone lines to customers,  
2 comprising:  
3           speed pre-qualifying a plurality of customer lines from one-ended electrical  
4 measurements made by a test unit switchably connected to the plurality of customer lines,  
5 the speed pre-qualifying including classifying the lines for at least high speed digital  
6 service or low speed digital service; and  
7           selectively offering the high-speed service to at least a portion of the customers ~~in~~  
8 ~~response to the portion~~ having lines qualified to support high-speed digital service.

1           26.    (Twice Amended) A method of marketing telephone lines to customers,  
2 comprising:  
3           speed pre-qualifying each line for high-speed digital service or low-speed digital  
4 service by using one-ended electrical measurements;  
5           receiving requests for high speed digital data service from customers; and  
6           connecting at least a portion of the lines qualified for high-speed digital service to  
7 customers requesting high-speed digital service in response to receiving said requests;  
8 wherein at least a portion of the measurements are performed on a proxy line.

1           31.    (Twice Amended) A system for characterizing performance of customer  
2 lines for data transmission, comprising:  
3           a computer;  
4           a telephony switch coupled to a portion of the lines and adapted to connect the  
5 portion to a network, to perform one-ended electrical measurements on the portion, and to  
6 transmit the measurements to the computer;

7 a measurement unit coupled to the switch and computer, the unit to make the  
8 measurements on a selected line at a lower frequency in response to receiving a command  
9 from the computer, the computer to predict data rates at a higher frequency for the  
10 selected line from the measurements, the computer being further adapted to:

11 predict whether the selected line is disqualified for data transmission from the  
12 measurements thereon;

13 wherein the computer is adapted to determine a frequency dependent attenuation  
14 from the measurements.

1 53. (Three Times Amended) A method of detecting a bridged tap in a customer line,  
2 comprising:

3 making one-ended electrical measurements over a range of frequencies on  
4 the customer line;

5 determining one or more admittances as a function of frequency of the  
6 customer line from the measurements; and

7 detecting that the customer line has a bridged tap in response to finding a  
8 signature of a bridged tap in the one or more admittances as a function of frequency.

1 54. (Twice Amended) The method of claim 53, wherein the method is used in  
2 qualifying a line for high speed data services and the one ended measurements are made  
3 at a range of frequencies that are frequency below the frequency of the high speed data  
4 services signals.



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## CLAIMS

(As presented May 3, 2002)

1           1.     A method of predicting performance of a customer line for data  
2     transmission, comprises:  
3             measuring electrical properties of the customer line from a central location;  
4             identifying a line model for the customer line from the measurements;  
5             identifying a modem model for a modem selected for use with the line, the modem  
6     model providing performance data on the selected modem; and  
7             predicting performance data for the customer line when operated with the selected  
8     modem by combining the line and modem models.

1           2.     The method of claim 1, wherein the performance data comprises a data  
2     transmission rate.

1           3.     The method of claim 2, further comprising:  
2             predicting whether the customer line is disqualified for data transmission; and  
3             wherein the act of predicting performance data is in response to predicting that the  
4     line is not disqualified.

1           4.     The method of claim 1, wherein the act of measuring includes using the  
2     measurements to evaluate at least one admittance of the customer line at a plurality of  
3     frequencies.

1           5.     The method of claim 4, wherein the act of measuring includes finding at  
2     least two of  $Y_{tr}$ ,  $Y_{rg}$ , and  $Y_{tg}$  for the customer line.

1           6.     The method of claim 5, wherein the act of identifying a line model  
2     comprises:  
3             determining a frequency dependent attenuation from the admittances; and  
4             determining a normalized line length from the frequency dependent attenuation.

1           7.     The method of claim 4, wherein the act of identifying a line model  
2     comprises:

3 determining whether the customer line has a bridged tap.

1 8. The method of claim 1, wherein the act of identifying a line model includes  
2 finding a frequency dependent line attenuation from the measurements.

1 9. The method of claim 1,  
2 wherein the act of measuring includes driving the customer line with a signal at a  
3 plurality of frequencies; and  
4 the act of identifying a line model includes evaluating a property of the customer  
5 line for frequencies high with respect to the frequencies of the signal.

1 10. The method of claim 1, wherein the act of measuring includes finding a  
2 noise level, a capacitance, and frequency dependent admittances for the customer line.

1 11. The method of claim 2, wherein the modem model indexes predicted data  
2 rates by an averaged normalized line length and a noise level of the customer line.

1 12. (Amended) A method of speed qualifying a customer line for data  
2 transmission, comprises:  
3 identifying a proxy line in a cable carrying the customer line;  
4 performing one-ended electrical measurements on the proxy line; and  
5 predicting a data rate for the customer line from the measurements.

1 13. The method of claim 12, wherein the act of predicting a data rate further  
2 comprises:  
3 identifying a line model for the proxy line from the measurements;  
4 identifying a modem model for a modem to use with the customer line; and  
5 combining the modem model with the line model to obtain the data rate.

1 14. The method of claim 13, wherein the act of identifying a line model includes  
2 finding at least two of  $Y_{tr}$ ,  $Y_{rg}$ , and  $Y_{tg}$  for the proxy line at a plurality of frequencies.

1           15.     The method of claim 14, further comprising one of inferring a mix of wire  
2     gauges and inferring the presence of a bridged tap from the found admittances.

1           16.     The method of claim 14, wherein the act of identifying a line model includes  
2     finding a frequency dependent line attenuation from the measurements.

1           17.     The method of claim 12,  
2             wherein the act of performing includes driving the proxy line with a signal having a  
3     plurality of frequencies; and  
4             the act of identifying a line model includes evaluating a property of the proxy line  
5     for frequencies high with respect to the frequencies of the signal.

1           18.     (Amended) The method of claim 13, wherein the modem model indexes  
2     predicted data rates by an averaged normalized line length and a noise level of the customer  
3     line.

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1           19.     (Amended) A method of marketing telephone lines to customers,  
2     comprising:  
3             speed pre-qualifying a plurality of the customer lines using one-ended electrical  
4     measurements performed from a central location; and  
5             setting billing rates of at least a portion of the lines at prices that depend on the speed  
6     qualification of the portion;  
7     wherein at least a portion of the acts of speed qualification include performing electrical  
8     measurements on a proxy line.

1           21.     The method of claim 19, further comprising:  
2             monitoring a portion of the customer lines after being placed in service by  
3     repeatedly performing one-ended electrical measurements on the portion; and  
4             determining new data rates of each line of the portion from the repeated  
5     measurements.

1           22.     The method of claim 19, wherein each act of speed pre-qualifying,  
2     comprises:

3 measuring electrical properties of one of the lines from the central location;  
4 identifying a line model for the one of the lines from the measured electrical  
5 properties;  
6 identifying a modem model for a modem to use with the one of the lines, the modem  
7 model to provide rate data on the selected modem; and  
8 predicting a data rate for the one of the lines when operated with the selected modem  
9 by combining the line and modem models.

1 23. The method of claim 22, the act of speed pre-qualifying the one of the lines  
2 further comprising:  
3 predicting whether the one of the lines is disqualified for data transmission; and  
4 wherein the act of predicting a data rate is in response to predicting that the one of  
5 the lines is not disqualified.

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E2  
1 24. (Twice Amended) A method of marketing telephone lines to customers,  
2 comprising:  
3 speed pre-qualifying a plurality of customer lines from one-ended electrical  
4 measurements made by a test unit switchably connected to the plurality of customer lines,  
5 the speed pre-qualifying including classifying the lines for at least high speed digital service  
6 or low speed digital service; and  
7 selectively offering the high-speed service to at least a portion of the customers  
8 having lines qualified to support high-speed digital service.

1 25. The method of claim 24, wherein each act of speed qualifying comprises:  
2 measuring electrical properties of one of the lines from the central location;  
3 identifying a line model for the one of the lines from the electrical properties;  
4 identifying a modem model for use with the one of the lines, the modem model  
5 providing data rates for the selected modem; and  
6 predicting a data rate for the one of the lines when operated with the selected modem  
7 by combining the line and modem models.

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G1  
1 26. (Twice Amended) A method of marketing telephone lines to customers,  
2 comprising:

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3 speed pre-qualifying each line for high-speed digital service or low-speed digital  
4 service by using one-ended electrical measurements;  
5 receiving requests for high speed digital data service from customers; and  
6 connecting at least a portion of the lines qualified for high-speed digital service to  
7 customers requesting high-speed digital service in response to receiving said requests;  
8 wherein at least a portion of the measurements are performed on a proxy line.

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1 27. The method of claim 26, wherein each act of speed pre-qualifying  
2 comprises:  
3 measuring electrical properties of one of the lines from the central location;  
4 identifying a line model for the one of the lines from the electrical properties;  
5 identifying a modem model for use with the one of the lines, the modem model  
6 providing transmission rate data on the selected modem; and  
7 predicting a data rate for the one of the lines when operated with the selected modem  
8 by combining the line and modem models.

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1 30. (Amended) The system of claim 31, wherein the computer is adapted to:  
2 identify a line model for the selected line from the measurements thereon;  
3 identify a modem model for use with the selected line; and  
4 predict a data rate for the selected line when operated with the selected modem by  
5 combining the line and modem models.

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U3  
U2  
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1 31. (Twice Amended) A system for characterizing performance of customer  
2 lines for data transmission, comprising:  
3 a computer;  
4 a telephony switch coupled to a portion of the lines and adapted to connect the  
5 portion to a network, to perform one-ended electrical measurements on the portion, and to  
6 transmit the measurements to the computer;  
7 a measurement unit coupled to the switch and computer, the unit to make the  
8 measurements on a selected line at a lower frequency in response to receiving a command

9 from the computer, the computer to predict data rates at a higher frequency for the selected  
10 line from the measurements, the computer being further adapted to:

E4 11 predict whether the selected line is disqualified for data transmission from the  
12 measurements thereon;

13 wherein the computer is adapted to determine a frequency dependent attenuation  
14 from the measurements.

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1  
1 33. The system of claim 30, wherein the computer is adapted to command the  
2 measurement unit to order measurements on proxy lines and to predict data rates for a  
3 portion of the customer lines by using the measurements on the proxy lines  
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1 34. A program storage device encoding an executable program for a method of  
2 speed qualifying telephone lines for data transmission, the method comprising:  
3 measuring electrical properties of a customer line from a central location;  
4 identifying a line model for the customer line from the measurements;  
5 identifying a modem model for use with the line, the modem model providing data  
6 rates of the selected modem; and  
7 predicting a data rate for the customer line when operated with the selected modem  
8 by combining the line and modem models.

1 35. The device of claim 34, the method further comprising:  
2 predicting whether the customer line is disqualified for data transmission; and  
3 wherein the act of predicting a data rate is performed in response to predicting that  
4 the line is not disqualified.

1 36. The device of claim 34, wherein the act of measuring includes finding at  
2 least one admittance of the customer line at a plurality of frequencies by using the  
3 measurements.

1 37. The device of claim 36, wherein the act of measuring includes finding at  
2 least two of  $Y_{tr}$ ,  $Y_{rg}$ , and  $Y_{tg}$  for the customer line.



1           38.     The device of claim 36, wherein the act of identifying a line model includes  
2 finding a frequency dependent line attenuation from the measurements.

1           39.     The device of claim 36, wherein the act of identifying a line model  
2 comprises:  
3           determining a frequency dependent attenuation from the admittances; and  
4           determining a normalized line length from the frequency dependent attenuation.

1           40.     The device of claim 34, wherein the modem model lists predicted data rates  
2 by averaged normalized line length and noise level of the customer line.

1           41.     The device of claim 40, the method further comprising:  
2           modifying the predicted data rate in response to a value of one or more quality  
3 parameters, the values characterizing the selected modem.

1           42.     The device of claim 41, wherein the parameters are selected from the group  
2 consisting of impulse noise compensation, noise floor, echo compensation and phase  
3 instability compensation.

1           43.     The device of claim 34, the method further comprising:  
2           identifying the customer line as a proxy line for a second telephone line; and  
3           predicting a data rate for the second line from the data rate predicted for the proxy  
4 line.

1           44.     A method of determining the attenuation of a customer's telephony line,  
2 comprising:  
3           performing a plurality of one-ended measurements of frequency dependent  
4 admittances of the customer's telephony line, the measurements being performed in a first  
5 frequency range;  
6           processing the measurements by a set of logical decision trees; and  
7           adjusting values of a frequency-dependent attenuation for an average telephony line  
8 to predict an attenuation of the customer's telephony line in a second frequency range, the  
9 act of adjusting being responsive to results from the logical decision trees.

1           45.     The method of claim 44, wherein the act of performing includes finding at  
2     least two of  $Y_{tr}$ ,  $Y_{rg}$ , and  $Y_{tg}$  for the customer's telephony line.

1           46.     A method of determining performance of a customer telephone line, the line  
2     having both a tip wire and a ring wire, comprising:  
3           driving one of the two wires with a first alternating voltage at one end and the other  
4     of the two wires with a second voltage at the same end and measuring voltages between  
5     each wire and ground while driving the two wires;  
6           driving the other of the two wires with a third alternating voltage at the same end  
7     and the one of the two wires with a fourth voltage at the same end and measuring voltages  
8     between each wire and ground while driving the two wires;  
9           driving both the tip and the ring wires with a fifth alternating voltage from  
10    the same end and measuring voltages at the tip and ring wires while driving both wires;  
11    and  
12           determining admittance  $Y_{tg}$  at a plurality of frequencies from the measured voltages.

1     47.     The method of claim 46, further comprising:  
2           determining an apparent length of the customer line from values of said  
3           admittance at a plurality of frequencies.

1     48.     The method of claim 46, further comprising:  
2           determining whether the customer line has a bridged tap from values of  
3           said admittance at a plurality of frequencies.

1     49.     The method of claim 46, further comprising:  
2           determining the remaining admittances  $Y_{rg}$  and the admittance  $Y_{rt}$  at a plurality of  
3     frequencies from the measured voltages.

1     50.     The method of claim 49, further comprising:  
2           determining a frequency-dependent attenuation of the line from the measured  
3     admittances.

1     51.     The method of claim 50, further comprising:

2 predicting a data rate for the line from the attenuation; and  
3 adjusting the predicted data rate in response to a rating of a gauge mix of  
4 the line.

1 52. The method of claim 50, further comprising:  
2 determining whether the customer line has a bridged tap from values of  
3 said admittances at a plurality of frequencies;  
4 predicting a data rate for the line from the attenuation; and  
5 adjusting the predicted data rate in response to determining that the customer line  
6 has a bridged tap.

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*Sub F3*  
1 53. (Three Times Amended) A method of detecting a bridged tap in a customer line,  
2 comprising:  
3 making one-ended electrical measurements over a range of frequencies on  
4 the customer line;  
*E5* 5 determining one or more admittances as a function of frequency of the  
6 customer line from the measurements; and  
7 detecting that the customer line has a bridged tap in response to finding a  
8 signature of a bridged tap in the one or more admittances as a function of frequency.

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*Sub G*  
1 54. (Twice Amended) The method of claim 53, wherein the method is used in  
2 qualifying a line for high speed data services and the one ended measurements are made  
3 at a range of frequencies that are below the frequency of the high speed data services  
4 signals.

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1 55. The method of claim 53, wherein the one or more admittances is an admittance  
2 between a wire of the customer line and ground.

1 56. The method of claim 53, wherein the act of making one-ended measurements  
2 performs the measurements through a voice test access of a telephony switch.

1 57. (Amended) The method of claim 53, further comprising:

2 determining whether a ratio of imaginary and real parts of a frequency  
3 derivative of one of the one or more admittances has a peak; and  
4 wherein the determining is based on finding an above threshold peak in  
5 the ratio.